

Chapter 1: Introduction and Overview

INTRODUCTION

EPA is proposing regulations implementing Section 316(b) of the Clean Water Act (CWA) for new facilities (33 U.S.C. 1326(b)). The proposed rule would establish national requirements applicable to the location, design, construction, and capacity of cooling water intake structures (CWISs) at new facilities. The proposed national requirements would minimize the adverse environmental impact associated with the use of these structures. CWISs may cause adverse impact due to impingement (where fish and other aquatic life are trapped on equipment at the entrance to CWISs) and entrainment (where aquatic organisms, eggs, and larvae are taken into the cooling system, passed through the heat exchanger, and then pumped back out with the discharge from the facility).

EPA is developing these regulations pursuant to a Consent Decree entered on October 10, 1995 in Cronin v. Reilly,¹ a lawsuit brought against the Agency by a coalition of individuals and environmental groups headed by the Riverkeeper (formerly known as the Hudson Riverkeeper). With this rule, EPA will establish best technology available (BTA) standards for new facilities which are point sources under the CWA and which will operate CWISs that withdraw water used for cooling purposes from a water of the United States.

Not covered under this proposed regulation are existing facilities operating CWISs, including existing facilities proposing substantial additions or modifications to their operations. These facilities will be addressed by a separate rule.

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1.1 SCOPE OF THE PROPOSED REGULATION

The *Economic and Engineering Analyses of the Proposed §316(b) New Facility Rule* (EEA) assesses the economic impacts of the proposed §316(b) New Facility Rule. Facilities covered under this regulation include any facility that meets the “new facility” criteria established for this regulation, is considered a point source under Sections 301 or 306 of the CWA, and proposes to operate a CWIS that will withdraw water for cooling purposes from a water of the United States.

For this proposed regulation, EPA divided new facilities into two groups:

- ▶ **Electric generators:** these are new facilities engaged in the generation of electricity using a steam electric prime mover; and
- ▶ **Manufacturing facilities:** these are new facilities engaged in a primary economic activity other than electricity generation.

EPA estimates 40 new electric generators and 58 new manufacturing facilities will be subject to the proposed §316(b) New Facility Rule over the next 20 years.

¹ United States District Court, Southern District of New York, 93 Civ. 0314 (AGS).

1.2 DEFINITIONS OF KEY CONCEPTS

This EEA presents EPA’s analyses of costs, benefits, and potential economic impacts as a result of the proposed §316(b) regulation. In addition to important economic concepts, which will be presented in the following chapters, understanding this document requires familiarity with a few key concepts applicable to CWA §316(b) and this regulation. This section defines these key concepts.

- ▶ **Cooling Water Intake Structure (CWIS):** The total physical structure and any associated constructed waterways used to withdraw from a water of the U.S., provided at least twenty-five percent of the water withdrawn is used for cooling purposes. The CWIS extends from the point at which water is withdrawn from the water source to the first intake pump or series of pumps.
- ▶ **Entrainment:** The incorporation of fish, eggs, larvae, and other plankton with intake water flow entering and passing through a CWIS and into a cooling water system.
- ▶ **Impingement:** The entrapment of aquatic organisms on the outer part of an intake structure or against screening devices during periods of intake water withdrawal.
- ▶ **Manufacturing Facility.** An establishment engaged in the mechanical or chemical transformation of materials or substances into new products. Manufacturing facilities are classified under Standard Industrial Classification (SIC) Codes 20 to 39 (U.S. DOL, 2000).
- ▶ **New Facility.** Any building, structure, facility, or installation which meets the definition of a “new source” or “new discharger” in 40 CFR 122.2 and 122.29(b)(1), (2), and (4); commences construction after the effective date of this rule; and has a new or modified CWIS.
- ▶ **Steam-Electric Generator.** A facility employing one or more generating units in which the prime mover is a steam turbine. The turbines convert thermal energy (steam or hot water) produced by generators or boilers to mechanical energy or shaft torque. This mechanical energy is used to power electric generators, which convert the mechanical energy to electricity, including combined cycle electric generating units. Electric generators are classified under SIC Major Group 49 (*Electric, Gas, And Sanitary Services*).

1.3 SUMMARY OF THE PROPOSED REGULATION

Section §316(b) is already in effect, but in the absence of national standards, the implementation has varied widely. The proposed §316(b) New Facility Rule establishes a national framework that would set minimum compliance requirements for the location, design, construction, and capacity of CWISs for new facilities. Facilities are subject to the rule only if they meet the following criteria:

- ▶ they use a CWIS to withdraw from a water of the U.S.;
- ▶ they have or require a National Pollutant Discharge Elimination System (NPDES) permit issued under section 402 of the Clean Water Act (CWA);
- ▶ they have a design intake flow of greater than two million gallons per day (MGD); and
- ▶ they use at least twenty-five percent of the water withdrawn for cooling purposes.

The specific requirements of the proposed rule depend on the location of the CWIS and address three of its primary characteristics: (1) design intake flow; (2) design intake velocity, and (3) technologies that minimize I&E of fish eggs and larvae and maximize survival of impinged adult and juvenile fish (“other §316(b) technologies”). The proposed rule also provides for additional, site-specific, requirements defined by the Director.²

The following subsections discuss the role of location in the proposed §316(b) New Facility Rule and present the specific BTA standards required under the rule.

a. Location

Location is generally considered one of the most important factors in a CWIS’s potential to cause AEI. Everything else being equal, CWISs located in biologically sensitive areas are much more likely to impinge and entrain aquatic organisms than CWISs located in less sensitive areas. As a result, the specific combination of flow, velocity, and technology requirements under the proposed rule depends on the location of the CWIS. Two aspects of location are important: (1) the type of water body from which a facility proposes to draw water, and (2) the proximity of the CWIS to biologically sensitive areas within the water body.

² The term “Director” means the State or Tribal Director where there is an approved National Pollutant Discharge Elimination System (NPDES) State or Tribal program, and the Regional Administrator where EPA administers the NPDES program in the State.

❖ *Water body type*

Different types of water bodies have different biological and ecological characteristics and will experience varied impacts from the withdrawal of water by CWISs. The proposed rule groups water bodies into four categories: (1) freshwater rivers or streams, (2) lakes or reservoirs, (3) tidal rivers or estuaries, and (4) oceans. The proposed compliance requirements vary by water body type, with the most sensitive water body types having the most stringent requirements. For the purposes of this rule, these water body types are defined as follows:

- ▶ ***Freshwater river or stream*** means a lotic (free-flowing) system that does not receive significant inflows of water from oceans or bays due to tidal action.
- ▶ ***Lake*** means any inland body of open water with some minimum surface area free of rooted vegetation and with an average hydraulic retention time of more than seven days. Lakes might be natural water bodies or impounded streams, usually fresh, surrounded by land or by land and a man-made retainer (e.g., a dam). Lakes might be fed by rivers, streams, springs, and/or local precipitation. ***Reservoir*** means any natural or constructed basin where water is collected and stored.
- ▶ ***Tidal river*** means the most seaward reach of a river or stream where the salinity is less than or equal to 0.5 parts per thousand (by mass) at a time of annual low flow and whose surface elevation responds to the effects of coastal lunar tides. ***Estuary*** means all or part of the mouth of a river or stream or other body of water having an unimpaired natural connection with open seas and within which the sea water is measurably diluted with fresh water derived from land drainage. The salinity of an estuary exceeds 0.5 parts per thousand (by mass), but is less than 30 parts per thousand (by mass).
- ▶ ***Ocean*** means marine open coastal waters with a salinity greater than or equal to 30 parts per thousand (by mass).

Tidal rivers and estuaries are generally considered the most sensitive biological areas among the different water body types. The potential for environmental impact, and therefore the stringency of compliance requirements, for CWISs located in freshwater rivers and streams, lakes and reservoirs, or oceans depends on the specific placement of the CWIS's opening in the source water body. This aspect of location is discussed in the next subsection.

❖ *Proximity to biologically sensitive areas*

In addition to the type of water body, the requirements of the proposed §316(b) New Facility Rule for all water body types

except tidal rivers/estuaries depend on the proximity of the CWIS to areas of high biological productivity. This proposed rule considers the littoral zone of a water body to be the area of highest biological productivity. The littoral zone is defined as the area where the physical, chemical, and biological attributes of aquatic systems promote the congregation, growth, and propagation of individual aquatic organisms, including egg, larvae, and juvenile stages.³

All parts of tidal rivers and estuaries have the potential for high biological productivity. Therefore, this rule only establishes one set of requirements for CWISs located within these areas. Facilities proposing to locate on a tidal river or estuary are subject to the most stringent set of requirements and are required to employ the broadest suite of technologies.

The term “littoral zone” in a freshwater river/stream or a lake/reservoir is defined as any nearshore area extending from the level of highest seasonal water to (1) the deepest point at which submerged aquatic vegetation can be sustained (the photic zone extending from shore to the substrate receiving one percent of incident light); or (2) where there is a significant change in slope that causes changes in the habitat and/or community structure); or (3) where there is a significant change in the composition of the substrate (e.g., cobble to sand, sand to mud). For freshwater rivers/streams and lakes/reservoirs, the proposed rule defines three categories of proximity to the littoral zone:

- ▶ ***Category 1*** establishes requirements for CWISs located *at least 50 meters outside the littoral zone*. CWISs that meet this location criterion are subject to the least stringent set of compliance requirements among the three categories.
- ▶ ***Category 2*** establishes requirements for CWISs located *less than 50 meters outside but not inside the littoral zone*. The requirements for Category 2 CWISs are more stringent than those for Category 1 CWISs.
- ▶ ***Category 3*** establishes requirements for CWISs located *in the littoral zone*. CWISs that meet this location criterion are subject to the most stringent set of minimum requirements among the three categories.

In oceans, the littoral zone encompasses the photic zone of the neritic region. Neritic waters are those over the continental shelf and include the areas of marine fish and

³ For the purposes of determining the costs of the proposed §316(b) New Facility Rule, EPA assumed that the littoral zone of freshwater rivers and streams, lakes and reservoirs, and oceans begins at the shore and extends for 25 meters into the water body.

mammal migrations. The photic zone of neritic waters includes those areas that are sufficiently shallow and clear, and allow for light penetration sufficient to support primary productivity. This rule defines two categories of proximity to the littoral zone for CWISs proposing to withdraw cooling water from oceans:

- ▶ **Category 1** addresses CWISs located *outside the littoral zone*. CWISs in this category have less stringent standards than CWISs located in Category 2.
- ▶ **Category 2** addresses CWISs located *inside the littoral zone*. These CWISs are subject to the most stringent set of requirements among facilities proposing to withdraw water from oceans.

b. BTA Standards for the Proposed Rule

The proposed §316(b) New Facility Rule specifies a number of standards to minimize AEI. To enhance the economic efficiency of the rule, EPA designed these standards to give facilities maximum flexibility in meeting the regulatory requirements while at the same time achieving the goals of CWA §316(b). The combination and stringency of the compliance requirements depends on the locational variables discussed in the previous section. The proposed approach allows for a trade-off between locational characteristics of a CWIS and most of the other requirements discussed in this section. In general, EPA considers tidal rivers, estuaries, and the littoral zone of freshwater rivers/streams, lakes/reservoirs, and oceans as sensitive biological areas requiring the most stringent BTA requirements.

❖ *Design intake flow*

Intake flow refers to the volume of water that is withdrawn through the intake structure. Apart from location, the intake flow of a CWIS is the primary factor affecting the entrainment of organisms. Organisms entrained include small fish and immature life stages (eggs and larvae) of many species that lack sufficient mobility to move away from the area of the intake structure. Limiting the volume of the water withdrawn from a water body can limit the potential for these organisms to be entrained.

Design intake flow standards restrict the maximum flow a facility may withdraw from a water body. The proposed rule includes two restrictions on intake flows. First, it sets maximum flow rates relative to the flow of the source water body. These flow rates are expressed as a percentage of the water bodies' mean annual flow or volume and, for freshwater rivers and streams, as a percentage of the 7-day low flow for a period of 10 years (7Q10). Second, for some water body type/proximity to the littoral zone combinations, the proposed rule requires that facilities reduce their intake flow to a level that is commensurate with that which could be attained by a closed-cycle recirculating cooling system.

The specific requirements for design intake flow depend on the type of water body and the CWIS's proximity to the water body's littoral zone. These requirements are presented in Figure 1-1 below.

❖ *Design intake velocity*

Velocity refers to the speed with which water is drawn into a CWIS. Apart from location, intake velocity is the primary factor that affects the impingement of fish and other aquatic biota. Two measures of velocities are important in the design of a CWIS: approach velocity is the velocity measured just in front of the screen face or at the opening of the CWIS; through-screen or through-technology velocity is the velocity that is measured through the screen face or just as the organisms are entering the technology.

For most locations, a design intake velocity requirement would restrict the through-screen or through-technology velocity to 0.5 feet per second. Only CWISs located at least 50 meters from the littoral zone of a lake or reservoir would not be subject to a velocity standard.

❖ *Other §316(b) technologies*

The §316(b) New Facility Rule recognizes that it is not always possible for facilities to locate CWISs in areas outside of sensitive biological areas. The proposed rule therefore allows facilities to locate CWISs in sensitive biological areas, as long as they implement additional technologies that help reduce the impact on the aquatic environment. Such other §316(b) technologies include measures that minimize I&E of fish, eggs, and larvae, and technologies that maximize survival of impinged adult and juvenile fish.

Examples of technologies that minimize I&E include technologies that reduce intake velocities so that ambient currents can carry the organisms past the opening of the CWIS; intake screens such as fine mesh screens and Gunterbooms that exclude smaller organisms from entering the CWIS; passive intake systems such as wedge wire screens, perforated pipes, porous dikes, and artificial filter beds; and diversion and/or avoidance systems that serve to guide fish away from the intake before they are impinged or entrained. Examples of technologies that maximize survival of organisms after they have been impinged include fish handling systems such as bypass systems, fish buckets, fish baskets, fish troughs, fish elevators, fish pumps, spray wash systems, and fish sills. These technologies either prevent impingement by diverting organisms away from the CWIS or increase survival of impinged organisms by collecting them off the intake screens, protecting them from further damage, and transferring them back to the source water.

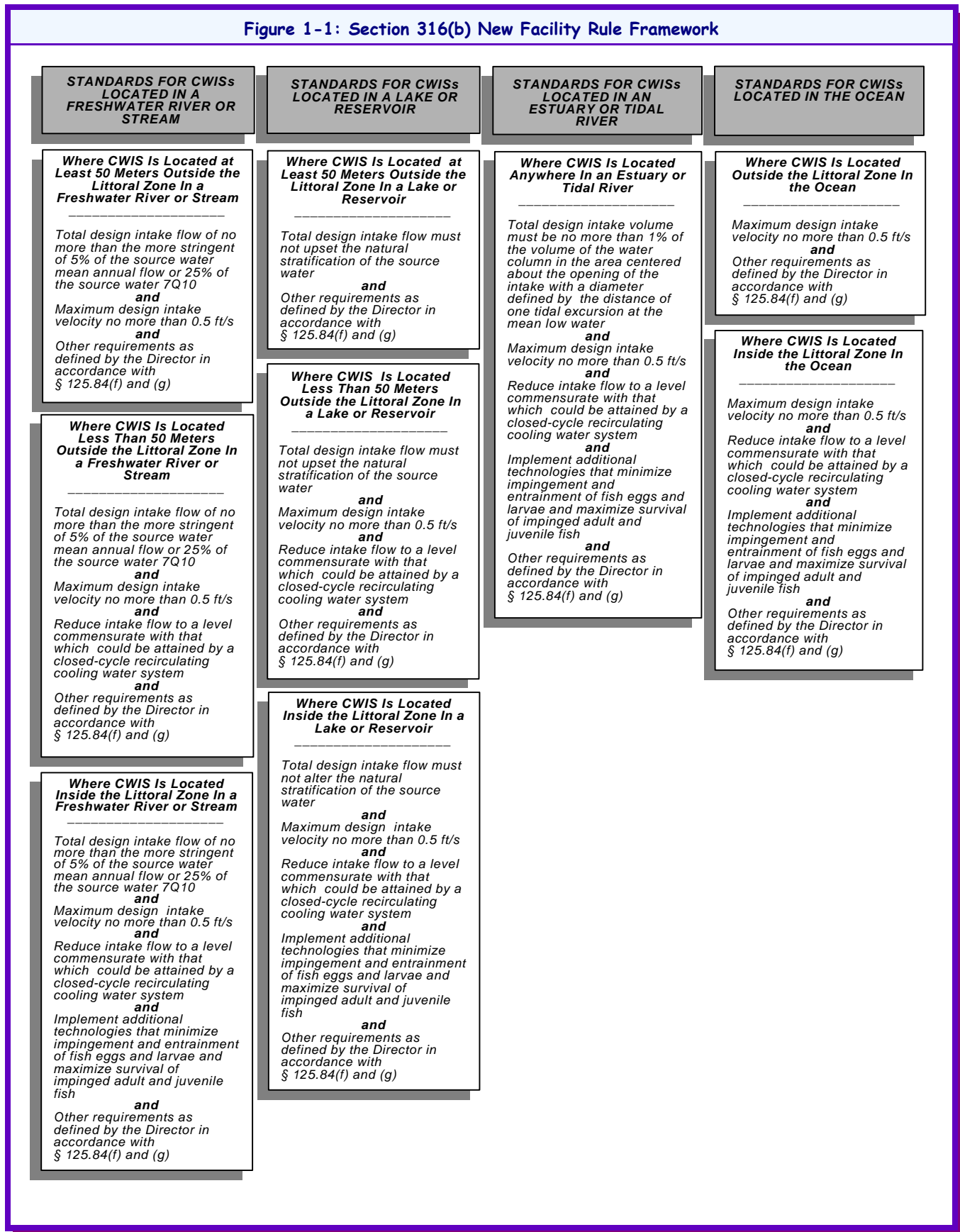
❖ *Additional requirements defined by the Director*

The proposed §316(b) New Facility Rule gives the Director discretionary authority to include more stringent permit conditions, in addition to the minimum requirements of the

rule, that are reasonably necessary to minimize adverse environmental impact caused by a CWIS.

Figure 1-1 displays the framework for EPA's proposed §316(b) New Facility Rule.

Figure 1-1: Section 316(b) New Facility Rule Framework



Source: Cooling Water Intake Structures: Section 316(b) New Facility Draft Preamble and Proposed Rule, EPA (2000).

1.4 STRUCTURE OF THE ECONOMIC ANALYSIS

The economic analysis in support of the proposed §316(b) New Facility Rule uses separate methodologies for new electric generators and for new manufacturing facilities:

The methodology for *new electric generators* relies on data for specific new facilities for which applications have been filed with state permitting authorities as well as results from the Energy Information Administration's (EIA) *Annual Energy Outlook 2000* (U.S. DOE, 1999). EPA estimated the number of new electric generators in scope of the proposed §316(b) New Facility Rule using facility-specific information from a database of planned new electric generation facilities (the NEWGen database; RDI, 2000) and EIA's national generating capacity forecasts (U.S. DOE, 1999). EPA estimated annual compliance costs for each in scope facility based on the expected technical characteristics of the new facilities. The cost estimates are then used to calculate two impact measures: annual compliance costs as a percentage of revenues, and initial compliance costs as a percentage of total plant construction costs.

The economic analysis for *new manufacturing facilities* relied on industry-specific growth projections to estimate the number of new manufacturing facilities expected to be in scope of this rule. EPA then used results from the §316(b) *Industry Screener Questionnaire: Phase I Cooling Water Intake Structures* (January 1999) on existing facilities to project technical characteristics as well as facility and firm employment and revenues for the new facilities. The cost estimates for new manufacturing facilities are based on these projected technical characteristics. EPA calculated annual compliance costs as a percentage of revenues as a measure of potential economic impacts.

1.5 ORGANIZATION OF THE EEA REPORT

The remaining chapters of this EEA are organized as follows:

- ▶ **Chapter 2: The §316(b) Industries and the Need for Regulation** provides a brief discussion of the industries affected by this regulation, discusses the environmental impacts from operating CWISs, and explains the need for this regulatory effort.

- ▶ **Chapter 3: Profile of the Electric Power Industry** presents a profile of the affected facilities, firms, and market for electric generators.
- ▶ **Chapter 4: Profile of Manufacturing Industries** presents profiles of the affected facilities, firms, and markets for manufacturing facilities.
- ▶ **Chapter 5: Baseline Projections of New Facilities** describes EPA's methodology and data sources for estimating the number of new electric generators and manufacturing facilities subject to this regulation.
- ▶ **Chapter 6: Facility Compliance Costs** summarizes the technology costs detailed in Appendix A of this regulation and estimates the costs of compliance for each facility in scope of the proposed rule. The chapter also presents facility compliance costs aggregated to the national level and provides compliance cost estimates for eight additional case study facilities.
- ▶ **Chapter 7: Economic Impact Analysis** presents the methodology used to estimate the economic impacts of the regulation and presents the impact analysis results.
- ▶ **Chapter 8: Regulatory Flexibility Analysis/SBREFA** presents EPA's estimates of small business impacts from the proposed §316(b) New Facility Rule.
- ▶ **Chapter 9: UMRA and Other Economic Analyses** outlines the requirements for analysis under the Unfunded Mandates Reform Act and presents the results of the analysis for this regulation. This chapter also presents the total social cost of the rule and addresses EPA's compliance with Executive Order 13132 on Federalism and the Paperwork Reduction Act of 1995.
- ▶ **Chapter 10: Alternative Regulatory Options** describes two alternative regulatory options considered by EPA and their costs.
- ▶ **Chapter 11: CWIS Impacts and Potential Benefits** presents a discussion of environmental impacts resulting from the operation of CWISs and provides a qualitative assessment of potential benefits from the proposed rule.

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